INFLUENCE OF SURFACE-BOUND WATER ON THE ELECTROPHYSICAL PROPERTIES OF MW– CNTS

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Annotation. This report is devoted to the investigation of a dispersed water / multiwalled carbon nanotubes system, from various degrees of humidity. Adsorption electrophysical and calorimetric behavior features of such systems are considered. The studies presented in this paper make it possible to reveal the characteristic behavior features of thin water films on the surface MWCNTs in a wide range of temperatures and frequencies. Particularly significant are the results in the area of phase transitions, which makes it possible to characterize the state of water as a bound state.

Until now many theoretical and experimental investigation has been devoted to the study different properties of disperse systems and composite materials with the CNTs addition. [1–4]. As one of the phases, researchers mainly choose a polymer matrix or liquid crystals. Note that the number of studies related to the dispersed system of CNT / water is much smaller [5] and have basically an eco-biological emphasis [6]. The CNT powder is a dispersed system, where CNT itself acts as the dispersed medium, and water plays the role of a dispersed phase. Due to adsorption of atmospheric moisture under real conditions, CNTs are always covered with a layer of water; this must be taken into account both in research and for the creation of various kinds of microelectronic devices and nanosystem [7]. In this connection, it becomes necessary to investigate the functional properties of such systems in dependence from humidity.

As a dispersed medium, CNT series Taunit M were taken. The preparation of specified humidity samples occurred by adsorption of water to CNTs from the gas phase. It was noted that the dependence of humidity on time has a step-like character. Within an hour, humidity reaches 7% and the next 6 hours remains constant. Next, the humidity continues to rise and reaches a maximum of 44%.

The results of measurements electrophysical properties are shown in Figure 1. Both quantitative and qualitative changes in the conductivity of the dispersed system were revealed depending on its moisture content. The temperature range has been determined, where the dependence of the conductivity on the frequency is not typical (see Fig. 1c). In this region, the conductivity has frequency dispersion with a pronounced and slightly temperature-dependent minimum of about 10^4 Hz. Also in the work researches of thermophysical properties of CNTs were carried out, which revealed significant differences in the heat capacity of the system as a humidity function. What of the author's opinion is the result of the thin film formation to bound water state on the CNTs surface.

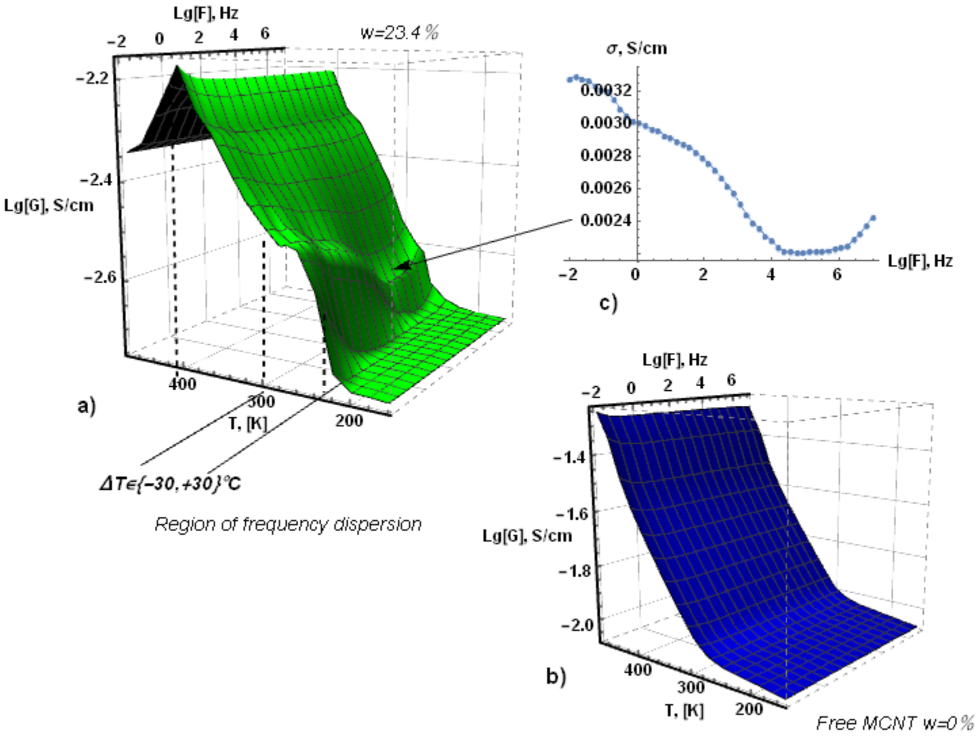

Figure 1. The dependence of the conductivity Lg [σ], from the frequency of the external field Lg[*F*], at different temperatures for a) MW–CNTs with a moisture content of 23.4%, b) free MW–CNT. The tab c) shows an atypical conductivity behavior at T=283°K.

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